

CHAPTER  
**12**

# Customary and Metric Measurement



## INVESTIGATION

### Using Data

Sunflowers can grow about 30 centimeters a week and can grow as high as 3 meters! The table shows how tall one sunflower grew in four weeks. If it continued to grow at the same rate, how tall would this sunflower be after 5 weeks? after 7 weeks?

*Yen*



### Growth of a Sunflower

Number of Weeks	Height in Centimeters
1	30
2	60
3	90
4	120

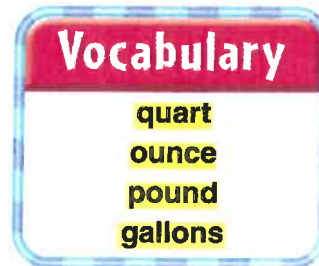
# Chapter Pretest

Use this page to review and remember what you need to know for this chapter.

## VOCABULARY

Choose the best word to complete each sentence.

1. A pencil weighs about one \_\_\_\_\_.
2. A grocer sells potatoes by the \_\_\_\_\_.
3. The amount of water in a swimming pool would best be measured in \_\_\_\_\_.



## CONCEPTS AND SKILLS

Measure to the nearest inch.



Choose the better unit of measure.

6. the width of a book  
a. meters   b. centimeters
7. the length of a car  
a. meters   b. kilometers
8. the length of an eraser  
a. inches   b. feet
9. the distance between towns  
a. yards   b. miles



10. Name 4 measuring tools that you have used. Describe how to use them and tell what you could measure with them.



**Test Prep on the Net**

Visit *Education Place* at  
[eduplace.com/kids/mw/](http://eduplace.com/kids/mw/)  
for more review.

# Explore Customary Units of Length

**Objective** Estimate and measure lengths, using an inch ruler.

## Vocabulary

inch (in.)  
half inch  
quarter inch  
eighth inch

### Work Together

Work with a partner to estimate length and then measure, using an inch ruler.



**STEP**

**1**

Estimate the length of the pea pod. Record your estimate in a table like the one at the right.

Estimate:

Nearest inch:

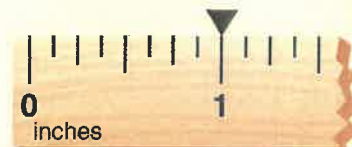
Nearest half inch:

Nearest quarter inch:

**STEP**

**2**

Use an **inch** ruler to measure the pea pod to the nearest inch. Use a **half-inch** mark to decide which inch mark is closer to the end of the pea pod. Record the length.



*If the end is exactly at the half-inch mark, round to the next inch.*

**STEP**

**3**

Now measure the pea pod to the nearest half inch. Use a **quarter-inch** mark to decide which half-inch mark is closer to the end. Record the length.



**STEP**

**4**

Measure the pea pod to the nearest quarter inch. Use an **eighth-inch** mark to decide which quarter-inch mark is closer to the end.



*The more marks your ruler has, the more accurately you will be able to measure.*

Compare your estimate and the three measurements of the pea pod. Which is closest to the actual length of the pea pod?

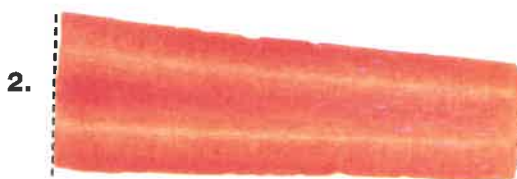
**STEP**  
**5**

Find five objects to measure. Estimate the length of each object to the nearest inch. Then measure each object to the nearest inch, half inch, and quarter inch. Record your work.



**On Your Own**

Measure to the nearest inch, half inch, and quarter inch.



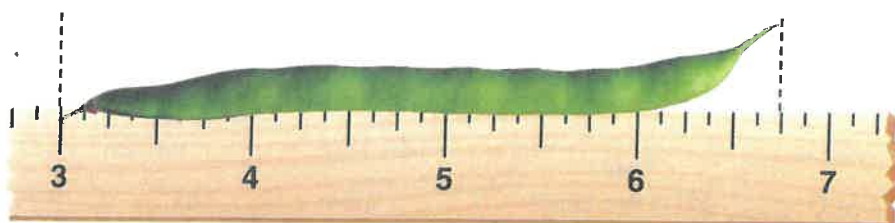
Estimate the length of each object to the nearest inch. Then measure to the nearest inch, half inch, and quarter inch.



**Talk About It • Write About It**

You have learned to measure to the nearest inch, half inch, and quarter inch.

- One green bean is less than 5 inches long, and another is more than 5 inches long. When they are measured to the nearest inch, both are about 5 inches long. Explain how this is possible.
- What is the length of this green bean to the nearest quarter inch?



# Inch, Foot, Yard, Mile

**Objective** Change units of length.

## Vocabulary

foot (ft)  
yard (yd)  
mile (mi)

### Learn About It



MathTracks 2/1  
Listen and Understand

The fourth grade planted flowers in the school courtyard. The length of the flower bed is 9 feet. What is the length in inches? in yards?



**Foot**, **yard**, and **mile** are customary units of measure.

### Change Feet to Inches

When you change from larger units to smaller units, the number of units increases. So multiply.

Multiply by the number of inches in 1 foot.

$$\begin{array}{ccccccc} 9 & \times & 12 & = & 108 \\ \uparrow & & \uparrow & & \uparrow \\ \text{number} & & \text{inches} & & \text{inches in} \\ \text{of feet} & & \text{in foot} & & \text{9 feet} \end{array}$$

### Customary Units of Length

1 foot (ft)	=	12 inches (in.)
1 yard (yd)	=	3 feet
1 yard (yd)	=	36 inches
1 mile (mi)	=	1,760 yards
1 mile (mi)	=	5,280 feet

### Change Feet to Yards

When you change from smaller units to larger units, the number of units decreases. So divide.

Divide by the number of feet in 1 yard.

$$\begin{array}{ccccccc} 9 & \div & 3 & = & 3 \\ \uparrow & & \uparrow & & \uparrow \\ \text{number} & & \text{feet in} & & \text{yards in} \\ \text{of feet} & & \text{1 yard} & & \text{9 feet} \end{array}$$

**Solution:** The length of the flower bed is 108 inches, or 3 yards.

### Other Examples

#### A. Miles to Yards

$$2 \text{ miles} = \underline{\hspace{2cm}} \text{ yards}$$

$$2 \times 1,760 = 3,520$$

$$2 \text{ miles} = 3,520 \text{ yards.}$$

#### Think

Miles are larger than yards, so multiply.

#### B. Feet to Yards

$$144 \text{ feet} = \underline{\hspace{2cm}} \text{ yards}$$

$$144 \div 3 = 48$$

$$144 \text{ feet} = 48 \text{ yards.}$$

#### Think

Feet are smaller than yards, so divide.

## Guided Practice

Find each missing number.

1.  $72 \text{ ft} = \underline{\quad} \text{ yd}$

2.  $\underline{\quad} \text{ in.} = 6 \text{ ft}$

3.  $2 \text{ mi} = \underline{\quad} \text{ ft}$

4.  $\underline{\quad} \text{ yd} = 144 \text{ in.}$

## Ask Yourself

- Am I converting to a larger or smaller unit?
- Should I multiply or divide?

**TEST TIPS**

**TEST TIPS**

## Explain Your Thinking

What unit of measure would you use to measure the length of your classroom?

## Practice and Problem Solving

Find each missing number.

5.  $72 \text{ yd} = \underline{\quad} \text{ ft}$

6.  $5 \text{ ft} = \underline{\quad} \text{ in.}$

7.  $10 \text{ yd} = \underline{\quad} \text{ ft}$

8.  $4 \text{ mi} = \underline{\quad} \text{ ft}$

9.  $\underline{\quad} \text{ yd} = 3 \text{ mi}$

10.  $21 \text{ ft} = \underline{\quad} \text{ yd}$

Compare. Write  $>$ ,  $<$ , or  $=$  for each.

11.  $3 \text{ ft} \quad \text{vs} \quad 36 \text{ in.}$

12.  $2 \text{ yd} \quad \text{vs} \quad 60 \text{ in.}$

13.  $5,280 \text{ yd} \quad \text{vs} \quad 2 \text{ mi}$

14.  $4 \text{ yd} \quad \text{vs} \quad 108 \text{ in.}$

15.  $5 \text{ ft} \quad \text{vs} \quad 60 \text{ in.}$

16.  $7 \text{ yd} \quad \text{vs} \quad 28 \text{ ft}$

Copy and complete the tables. Write the rule for each table.

17.

ft	2	3	5	8	9	12
in.	24	36				

18.

ft	3	6	9	12	15	30
yd	1		3			

Solve.

19. **Multistep** Alicia has a board that is 2 yards long. She cuts a 4-foot length for a fence. How long is the remaining piece?

20. Seth estimates the length of his garden to be 20 feet. Sarah estimates it to be 7 yards. If the actual length is 19 feet, which is the better estimate?

## Daily Review

## Test Prep

**Solve.** (Ch. 4, Lesson 5)

21.  $35 \div 7$

22.  $8 \times 9$

23.  $56 \div 8$

24.  $90 \div 10$

25.  $6 \times 7$

26.  $9 \times 5$

27.  $54 \div 9$

28.  $8 \times 7$

29.  $64 \div 8$



30. Which is the best unit for measuring the distance from New York to Chicago?

A inch

C yard

B foot

D mile

# Customary Units of Capacity

**Objective** Change units of capacity.

## Vocabulary

gallons  
quarts  
pints  
cups  
capacity



### Learn About It

LaToya's watering can holds 8 quarts of water. How many cups is that? how many gallons?

**Gallons, quarts, pints, and cups** all measure **capacity**, the amount a container can hold.

### Change Quarts to Cups

When you change from larger units to smaller units, the number of units increases. So multiply.

Multiply by the number of cups in 1 quart.

$$\begin{array}{ccccccc} 8 & \times & 4 & = & 32 \\ \uparrow & & \uparrow & & \uparrow \\ \text{number} & & \text{cups in} & & \text{cups in} \\ \text{of quarts} & & \text{1 quart} & & \text{8 quarts} \end{array}$$

### Customary Units of Capacity

1 pint (pt)	=	2 cups (c)
1 quart (qt)	=	2 pints
1 quart (qt)	=	4 cups
1 gallon (gal)	=	4 quarts
1 gallon (gal)	=	8 pints
1 gallon (gal)	=	16 cups

### Change Quarts to Gallons

When you change from smaller units to larger units, the number of units decreases. So divide.

Divide by the number of quarts in 1 gallon.

$$\begin{array}{ccccccc} 8 & \div & 4 & = & 2 \\ \uparrow & & \uparrow & & \uparrow \\ \text{number} & & \text{quarts in} & & \text{gallons in} \\ \text{of quarts} & & \text{1 gallon} & & \text{8 quarts} \end{array}$$

**Solution:** The watering can holds 32 cups, or 2 gallons, of water.

### Other Examples

#### A. Cups to Pints

$$10 \text{ cups} = \underline{\quad} \text{ pints}$$

$$10 \div 2 = 5$$

$$10 \text{ cups} = 5 \text{ pints}$$

**Think**

Cups are smaller than pints, so divide.

#### B. Gallons to Pints

$$3 \text{ gallons} = \underline{\quad} \text{ pints}$$

$$3 \times 8 = 24$$

$$3 \text{ gallons} = 24 \text{ pints}$$

**Think**

Gallons are larger than pints, so multiply.

## Guided Practice

Find each missing number.

1.  $8 \text{ c} = \underline{\quad} \text{ pt}$

2.  $\underline{\quad} \text{ qt} = 5 \text{ gal}$

3.  $16 \text{ pt} = \underline{\quad} \text{ qt}$

4.  $2 \text{ qt} = \underline{\quad} \text{ c}$

## Ask Yourself

- Am I converting to a larger or smaller unit?
- Should I multiply or divide?

**TEST TIPS**

**TEST TIPS**

**Explain Your Thinking** Describe how you found the missing number in Exercise 2.

## Practice and Problem Solving

Find each missing number.

5.  $14 \text{ c} = \underline{\quad} \text{ pt}$

6.  $8 \text{ gal} = \underline{\quad} \text{ qt}$

7.  $9 \text{ pt} = \underline{\quad} \text{ c}$

8.  $\underline{\quad} \text{ qt} = 10 \text{ pt}$

9.  $4 \text{ pt} = \underline{\quad} \text{ qt}$

10.  $16 \text{ c} = \underline{\quad} \text{ qt}$

Choose the unit you would use to measure the capacity of each. Write *cup*, *pint*, *quart*, or *gallon*.

11.



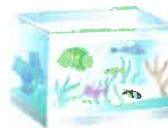
12.



13.



14.



Compare. Write  $>$ ,  $<$ , or  $=$  for each.

15.  $4 \text{ pt} \quad \square \quad 6 \text{ c}$

16.  $8 \text{ gal} \quad \square \quad 30 \text{ qt}$

17.  $13 \text{ pt} \quad \square \quad 8 \text{ qt}$

18.  $16 \text{ c} \quad \square \quad 8 \text{ qt}$

19.  $16 \text{ pt} \quad \square \quad 4 \text{ gal}$

20.  $2 \text{ qt} \quad \square \quad 4 \text{ c}$

21. **Explain** Which is the better buy, 4 quarts of plant food for \$5.00 or one half gallon for \$3.00? Explain how you got your answer.

22. Jane has 5 cups of water. Al has 3 pints and Bert has 1 quart of water. List amounts in order from least to greatest.

## Daily Review

## Test Prep

Round each number to the nearest hundred. Then estimate. (Ch. 3, Lesson 3)

23.  $5,321 - 2,192$

24.  $2,896 + 1,419$

25.  $7,099 - 3,299$

26.  $4,650 + 4,506$

27. **Free Response** How many times must Taylor fill his 1-pint measuring cup to make a recipe calling for  $\frac{1}{2}$  gallon of water? Explain how you got your answer.



# Customary Units of Weight

**Objective** Estimate and measure, using customary units of weight.

## Vocabulary

ounces  
pounds  
tons

### Learn About It

**Ounces**, **pounds**, and **tons** are units of weight. They are used to show how heavy an object is.



*A strawberry weighs about one ounce.*



*A bunch of grapes weighs about one pound.*



*A tractor weighs about one ton.*

**Try this activity to measure and compare weight.**

**Materials:** balance scale, 1 pound weight, 1 ounce weight



**STEP**  
**1**

Find three objects in the classroom that you estimate weigh about one pound.

**STEP**  
**2**

Weigh each object and record the weight. List the three objects from heaviest to lightest. Which object weighs closest to one pound?

**STEP**  
**3**

Use the one pound object to predict what other things in the classroom weigh. Make a list of four things that weigh more than, less than, and about one pound.

**STEP**  
**4**

Repeat Step 1 and Step 2 looking for four objects in the classroom that weigh about 1 ounce. Which object weighs closest to one ounce?



- Look at the truck. How many tons of watermelons are on it?



### Change Pounds to Tons

When you change from smaller units to larger units, the number of units decreases. So divide.

Divide by the number of pounds in 1 ton.

$$\begin{array}{ccccccc}
 4,000 & \div & 2,000 & = & 2 \\
 \uparrow & & \uparrow & & \uparrow \\
 \text{number} & & \text{pounds in} & & \text{tons in} \\
 \text{of pounds} & & \text{1 ton} & & \text{4,000 pounds}
 \end{array}$$

### Customary Units of Weight

1 pound (lb) = 16 ounces (oz)

1 ton (T) = 2,000 pounds

**Solution:** The truck carries 2 tons of watermelons.

- If one watermelon weighs 10 pounds, how many ounces does it weigh?



### Change Pounds to Ounces

When you change from larger units to smaller units, the number of units increases. So multiply.

Multiply by the number of ounces in 1 pound.

$$\begin{array}{ccccccc}
 10 & \times & 16 & = & 160 \\
 \uparrow & & \uparrow & & \uparrow \\
 \text{number} & & \text{ounces in} & & \text{ounces in} \\
 \text{of pounds} & & \text{1 pound} & & \text{10 pounds}
 \end{array}$$

**Solution:** The watermelon weighs 160 ounces.

### Guided Practice

Find each missing number.

- 8,000 lb = \_\_\_\_ T
- 5 lb = \_\_\_\_ oz
- 112 oz = \_\_\_\_ lb
- \_\_\_\_ lb = 3 T

### Ask Yourself

- Am I converting to a larger or smaller unit?
- Should I multiply or divide?

**TEST TIPS**

**TEST TIPS Explain Your Thinking** ► Do small objects always weigh less than large ones? Give examples to support your answer.

**Go On** ►

## Practice and Problem Solving

Find each missing number.

5. \_\_\_\_ lb = 16 T

6. 48 oz = \_\_\_\_ lb

7. \_\_\_\_ oz = 2 lb

8. 144 oz = \_\_\_\_ lb

9. 8,000 lb = \_\_\_\_ T

10. 10 lb = \_\_\_\_ oz

What is the best unit to weigh these items?

Write *ounce*, *pound*, or *ton*.

11. a bunch of bananas

12. a paper clip

13. a car

14. an elephant

15. a handful of blueberries

16. a table

Compare. Write  $>$ ,  $<$ , or  $=$  for each.

17. 38 oz  $\bullet$  2 lb

18. 3,000 lb  $\bullet$  3T

19. 5 lb  $\bullet$  80 oz

20. 2 lb  $\bullet$  40 oz

21. 90 oz  $\bullet$  6 lb

22. 2 T  $\bullet$  3,000 lb

23. Shonte bought a 9-pound watermelon that cost \$0.50 per pound. How much did she pay?

24. **Multistep** Darlene bought 3 pounds of peaches, 6 ounces of cherries and 14 ounces of plums. What was the total weight of her purchases?

25. Mario bought 3 pounds of fruit. He bought strawberries, cherries, grapes, and blueberries. How much did each type of fruit weigh if they weighed the same?



### Daily Review

### Test Prep

Round each number to the nearest hundred. Then estimate. (Ch. 3, Lesson 3)

26.  $7,091 + 2,802$

27.  $3,399 - 1,239$

28.  $4,511 + 5,499$

29.  $1,887 - 1,102$

30.  $3,271 + 4,010$

31.  $6,487 - 2,296$

32. How many ounces are in 5 pounds?

A 16 ounces      C 80 ounces

B 20 ounces      D 2,000 ounces

## Balancing Act

Which containers should you move so that each group has the same amount of juice?



Group A



Group B



## A Lot of Elephant!

An African elephant can weigh 12 tons. How many pounds is that?

An elephant can drink as much as 40 gallons of water a day. How many quarts is that?

An elephant's tusk can be as long as 8 feet. How many inches is that?



## Brain Teaser

A snail is climbing a 15-foot fence. Every day it climbs 3 feet, but slides back 1 foot every night. How long does it take the snail to climb to the top of the fence?



### Technology

Visit Education Place at [eduplace.com/kids/mw/](http://eduplace.com/kids/mw/) to try more brain teasers.

# Explore Metric Units of Length

e • Glossary

**Vocabulary**

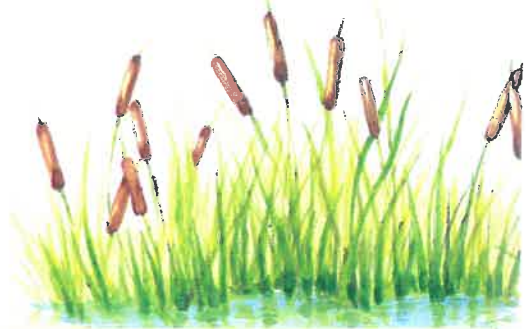
centimeter (cm)  
millimeter (mm)

**Objective** Estimate and measure lengths using a centimeter ruler:

**Materials**  
centimeter ruler

## Work Together

Work with a partner to estimate lengths. Then use a centimeter ruler to measure lengths.



**STEP 1**

Estimate the length of the cattail above. Record your estimate in a table like the one shown.

Object	Estimate	Nearest Centimeter	Nearest Millimeter
cattail			

**STEP 2**

Use a centimeter ruler to measure the length of the cattail to the nearest **centimeter**. Use a half-centimeter mark to decide which centimeter mark is closer to the end of the cattail. Record the length in your table.



*If the end is exactly halfway between centimeters, round to the next centimeter.*

**STEP 3**

Now measure the cattail to the nearest **millimeter**. Decide which millimeter mark is closer to the end of the cattail. Record the length in millimeters in your table.



*There are 10 millimeters in 1 centimeter.*

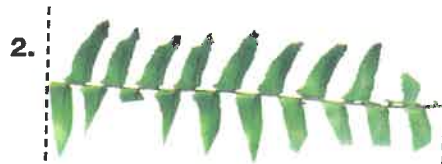
**STEP**  
**4**

Find 5 objects to measure. Estimate the length of each object to the nearest centimeter. Then measure each object to the nearest centimeter and millimeter. Record your work in your table.



**On Your Own**

Measure the length to the nearest centimeter and millimeter.



Estimate the length. Then measure each object to the nearest centimeter and millimeter.



**Talk About It • Write About It**

You have learned to measure lengths in centimeters and millimeters.

- Suppose you know how tall a plant is in centimeters. Explain how you can tell how tall it is in millimeters.
- Suppose you are measuring a piece of wood for a birdhouse. Would it be better to measure in centimeters or in millimeters? Explain your thinking.

# Metric Units of Length

**Objective** Change metric units of length.

## Learn About It



MathTracks 2/3  
Listen and Understand

**Millimeters, centimeters, decimeters, meters, and kilometers** are metric units used to measure length.



A corn kernel is about 1 centimeter long.



An ear of corn is about 2 decimeters long.



A young corn plant is about 1 meter tall.



The road is about 1 kilometer long.

## Vocabulary

millimeter (mm)

centimeter (cm)

decimeter (dm)

meter (m)

kilometer (km)

## Change Meters to Decimeters

When you change from larger units to smaller units, the number of units increases. So multiply.

Multiply by the number of decimeters in 1 meter.

$$\begin{array}{ccccccc}
 4,000 & \times & 10 & = & 40,000 \\
 \uparrow & & \uparrow & & \uparrow \\
 \text{number} & & \text{decimeters} & & \text{decimeters} \\
 \text{of meters} & & \text{in 1 meter} & & \text{in 4,000 meters}
 \end{array}$$

$$4,000 \text{ meters} = 40,000 \text{ decimeters}$$

## Metric Units of Length

$$1 \text{ centimeter (cm)} = 10 \text{ millimeters (mm)}$$

$$1 \text{ decimeter (dm)} = 10 \text{ centimeters}$$

$$1 \text{ meter (m)} = 10 \text{ decimeters}$$

$$1 \text{ kilometer (km)} = 1,000 \text{ meters}$$

## Change Meters to Kilometers

When you change from smaller units to larger units, the number of units decreases. So divide.

Divide by the number of meters in 1 kilometer.

$$\begin{array}{ccccccc}
 4,000 & \div & 1,000 & = & 4 \\
 \uparrow & & \uparrow & & \uparrow \\
 \text{number} & & \text{meters in} & & \text{kilometers in} \\
 \text{of meters} & & \text{1 kilometer} & & \text{4,000 meters}
 \end{array}$$

$$4,000 \text{ meters} = 4 \text{ kilometers}$$

## Other Examples

### A. Meters to Centimeters

$$5 \text{ meters} = \underline{\quad} \text{ centimeters}$$

$$5 \times 100 = 500$$

$$5 \text{ meters} = 500 \text{ centimeters}$$

### B. Millimeters to Centimeters

$$80 \text{ millimeters} = \underline{\quad} \text{ centimeters}$$

$$80 \div 10 = 8$$

$$80 \text{ millimeters} = 8 \text{ centimeters}$$

## Guided Practice

Find each missing number.

1.  $40 \text{ cm} = \underline{\quad} \text{ mm}$

2.  $200 \text{ cm} = \underline{\quad} \text{ m}$

3.  $3 \text{ km} = \underline{\quad} \text{ m}$

4.  $50 \text{ cm} = \underline{\quad} \text{ dm}$

## Ask Yourself

- Am I converting to a larger or smaller unit?
- Should I multiply or divide?

**TEST TIPS**

**TEST TIPS**

## Explain Your Thinking

What is the best unit to use when measuring the distance between two cities?

## Practice and Problem Solving

Find each missing number.

5.  $50 \text{ km} = \underline{\quad} \text{ m}$

6.  $600 \text{ mm} = \underline{\quad} \text{ cm}$

7.  $\underline{\quad} \text{ mm} = 9 \text{ cm}$

8.  $3 \text{ m} = \underline{\quad} \text{ cm}$

9.  $5,000 \text{ m} = \underline{\quad} \text{ km}$

10.  $\underline{\quad} \text{ dm} = 40 \text{ cm}$

Choose the better estimate of length.

11. length of a garden row  
a. 10 m    b. 10 mm

12. width of your fingertip  
a. 1 dm    b. 1 cm

13. the length of a street  
a. 3 km    b. 3 dm

14. the height of a window  
a. 1 m    b. 10 mm

Copy and complete the tables. Write the rule for each table.

15.

km	1	3	5	7	8
m	1,000	■	■	■	■

16.

mm	10	20	30	60	80
cm	1	■	■	■	■

17. **Estimate** Sue estimates that there are 9 dm between plants. Lee estimates 1 m. The actual distance is 97 cm. Who made the closer estimate?

18. **Multistep** Maxine has a piece of string that is 2 m long. If she cuts off a piece that is 105 cm long, will she have at least 35 cm left?

## Daily Review

## Test Prep

**Solve.** (Ch. 4, Lesson 5)

19.  $72 \div 9$

20.  $36 \div 6$

21.  $56 \div 7$

22.  $49 \div 7$

23.  $27 \div 9$

24.  $72 \div 8$

25. Which length is closest to 1 kilometer?

A 10 dm

C 1,000 cm

B 900 m

D 999 m



# Metric Units of Capacity

**Objective** Change metric units of capacity.

## Vocabulary

liter (L)

milliliter (mL)

### Learn About It

**Liter** and **milliliter** are units used to measure capacity in the metric system.



This bottle holds 1 liter.



This eyedropper holds 1 milliliter.

Try this activity to measure metric capacity.

**Materials:** containers of various sizes, liter measure marked in mL, water

### Metric Units of Capacity

1 liter (L) = 1,000 milliliters (mL)



**STEP 1**

Find three containers that you estimate will each hold about a liter of water.

**STEP 2**

Fill the liter measure with water. Pour it into the container you selected.

**STEP 3**

Decide if the capacity of each container is greater than, less than, or equal to a liter.

- Which container has a capacity closest to one liter? Explain how you know.

Container Estimated	More or Less Than 1 Liter
Container 1	
Container 2	
Container 3	

## Other Examples

### A. Liters to Milliliters

4 liters = \_\_\_\_\_ milliliters

$$4 \times 1,000 = 4,000$$

4 liters = 4,000 milliliters

### B. Milliliters to Liters

2,000 milliliters = \_\_\_\_\_ liters

$$2,000 \div 1,000 = 2$$

2,000 milliliters = 2 liters

## Guided Practice

Find each missing number.

1.  $9 \text{ L} = \underline{\hspace{2cm}} \text{ mL}$

2.  $\underline{\hspace{2cm}} \text{ L} = 5,000 \text{ mL}$

3.  $3,000 \text{ mL} = \underline{\hspace{2cm}} \text{ L}$

4.  $\underline{\hspace{2cm}} \text{ mL} = 4 \text{ L}$

### Ask Yourself

- Am I converting to a larger or smaller unit?
- Should I multiply or divide?

**TEST TIPS**

**TEST TIPS Explain Your Thinking** ▶ Why is it useful to measure capacity by using milliliters and liters instead of by using a small container and a large container?

## Practice and Problem Solving

Find each missing number.

5. \_\_\_\_\_ mL = 3 L

6. \_\_\_\_\_ L = 2,000 mL

7. 6,000 mL = \_\_\_\_\_ L

8. 10,000 mL = \_\_\_\_\_ L

9. 4,000 mL = \_\_\_\_\_ L

10. 25 L = \_\_\_\_\_ mL

Choose the better estimate of capacity of each:



- a. 20 mL    b. 20 L



- a. 400 mL    b. 400 L



- a. 250 mL    b. 25 L



- a. 8 mL    b. 8 L



- a. 215 mL    b. 215 L



- a. 280 mL    b. 28 L

**Go On** 

Choose the better unit to measure each capacity.

Write *milliliters* or *liters*.

17. a glass of milk      18. a kitchen sink      19. the juice from one lemon  
20. a bathtub      21. a spoon      22. a swimming pool

Compare. Write  $>$ ,  $<$ , or  $=$  for each.

23. 6 mL  $\circledast$  6,000 L      24. 8 L  $\circledast$  8,000 mL      25. 30 L  $\circledast$  300 mL  
26. 4,500 mL  $\circledast$  45 L      27. 4 L  $\circledast$  350 mL      28. 2,000 mL  $\circledast$  2 L  
29. 7 L  $\circledast$  7,000 mL      30. 550 mL  $\circledast$  5 L      31. 60 L  $\circledast$  60,000 mL

Solve.

32. Carla has 4 bottles of water. Each bottle has a capacity of 500 mL. How many liters of water can the bottles hold altogether?
33. **Multistep** It takes 12 average-size oranges to make 1 liter of orange juice. How many mL of juice can be expected from 18 oranges?
34. **Estimate** A recipe calls for 250 mL of apple juice. If the recipe is tripled, will a 1 L container of apple juice be enough?
35. **Multistep** A large cooler can hold 20 L and a small cooler can hold 5 L. How many more milliliters can a large cooler hold than a small cooler?

 **Data** Use the recipe for Problems 36–40.

36. How many liters will Sonya's punch recipe make?
37. **Multistep** How many 250 mL servings are in this recipe?
38. If each serving is 250 mL, how many liters of punch will be needed for 40 servings?
39. How many more milliliters of lemon-lime soda are in this recipe than orange juice?
40. **Money** How much will each 250 mL serving cost if the ingredients in the recipe cost a total of \$5.60?



# Metric Units of Mass

**Objective** Change metric units of mass.

## Vocabulary

gram (g)  
kilogram (kg)

### Learn About It

These four pumpkin seeds have a mass of 1 gram.  
The pumpkin has a mass of 45 kilograms.



**Gram** and **kilogram** are metric units of mass.

Try this activity to measure and compare mass.

**Materials:** balance, metric masses



**STEP**  
**1**

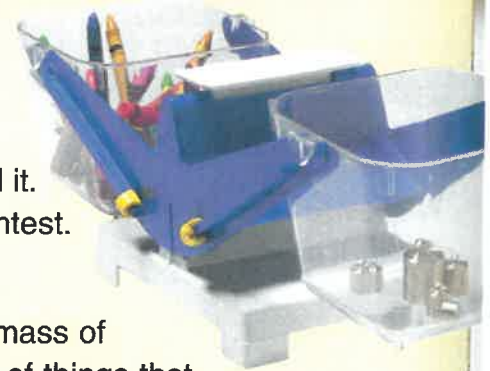
Find three objects in the classroom that you estimate will have a mass of 500 grams, 1 gram, and 100 grams.

**STEP**  
**2**

Determine each object's mass and record it. List the three objects from heaviest to lightest.

**STEP**  
**3**

Use the objects you found to predict the mass of other things in the classroom. Make a list of things that have a mass of about 1 gram, about 100 grams, and about 500 grams.



### Metric Units of Mass

1 kilogram (kg) = 1,000 grams (g)

### Other Examples

#### A. Kilograms to Grams

3 kilograms = \_\_\_\_ grams

$$3 \times 1,000 = 3,000$$

3 kilograms = 3,000 grams

#### B. Grams to Kilograms

2,000 grams = \_\_\_\_ kilograms

$$2,000 \div 1,000 = 2$$

2,000 grams = 2 kilograms

## Guided Practice

Find each missing number.

1.  $8 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

2.  $\underline{\hspace{2cm}} \text{ kg} = 9,000 \text{ g}$

3.  $\underline{\hspace{2cm}} \text{ kg} = 5,000 \text{ g}$

4.  $7 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

## Ask Yourself

- Am I converting to a larger or smaller unit?
- Should I multiply or divide?

TEST TIPS

TEST TIPS

## Explain Your Thinking

Why is mental math useful in converting kilograms to grams?

## Practice and Problem Solving

Find each missing number

5.  $5 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

6.  $\underline{\hspace{2cm}} \text{ kg} = 3,000 \text{ g}$

7.  $\underline{\hspace{2cm}} \text{ g} = 8 \text{ kg}$

8.  $10 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

9.  $\underline{\hspace{2cm}} \text{ g} = 4 \text{ kg}$

10.  $6 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$

Choose the better unit to measure each. Write *gram* or *kilogram*.

11. a paper clip

12. a stapler

13. a desk

14. a dictionary

15. a pencil

16. a cherry

Choose the better estimate of the weight of each.

17.



a. 40 g    b. 4 kg

18.



a. 450 g    b. 45 kg

19.



a. 60g    b. 6 kg

20.



a. 8 g    b. 8 kg

21.



a. 100 g    b. 10 kg

22.



a. 300 g    b. 300 kg

Go On

Compare. Write  $>$ ,  $<$ , or  $=$  for each .

23. 95 kg  $\bullet$  950 g

24. 3 kg  $\bullet$  3,000 g

25. 1,000 g  $\bullet$  2 kg

26. 5 g  $\bullet$  5,000 kg

27. 25 kg  $\bullet$  2,500 g

28. 700 g  $\bullet$  7 kg

29. 3 kg  $\bullet$  6,000 g

30. 125 kg  $\bullet$  4,000 g

31. 1,990 g  $\bullet$  19 kg

Solve.

32. **Estimate** Workers put apples in baskets that hold about 12 kg each. The workers filled 17 baskets. About how many kg of apples did they put in baskets?

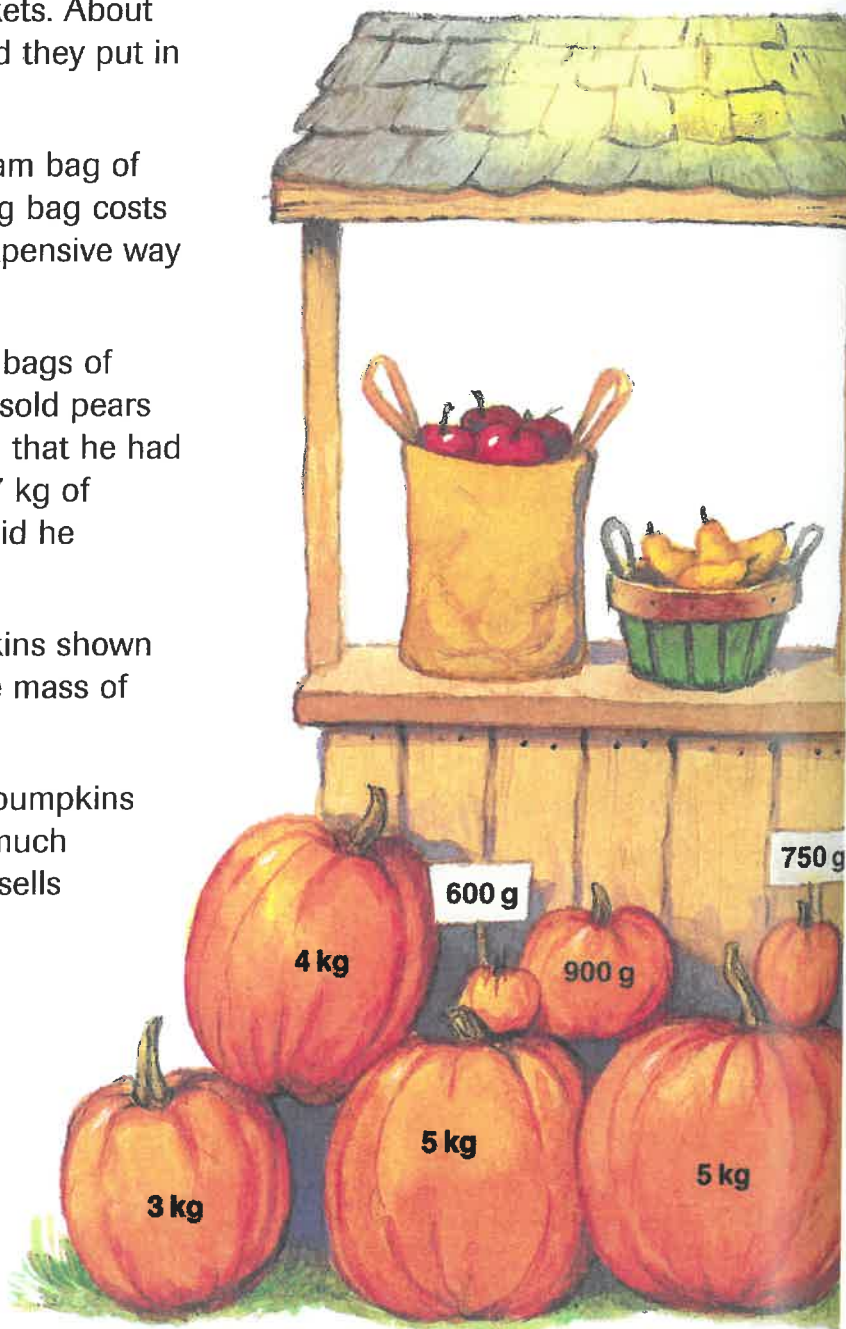


33. **Write About It** A 500-gram bag of peanuts costs \$2, and 2-kg bag costs \$6.50. What is the least expensive way to buy 5 kg of peanuts?

34. **Multistep** Paul sold 3-kg bags of apples for \$3.90 each. He sold pears for \$1.20 per kg. He found that he had sold 15 kg of apples and 7 kg of pears. How much money did he collect?

35. Delroy weighed the pumpkins shown below. What is the average mass of the pumpkins?

36. Delroy decided to sell the pumpkins for 1 cent per gram. How much money will he collect if he sells all the pumpkins?



# Quick Check



Check your understanding of lessons 6–9.

Estimate the length. Then measure to the nearest centimeter and millimeter. (Lesson 6)



Find each missing number. (Lesson 7–9)

2. 2,000 cm = \_\_\_\_\_ m      3. 20 cm = \_\_\_\_\_ dm      4. \_\_\_\_\_ L = 3,000 mL  
5. 9,000 mL = \_\_\_\_\_ L      6. 6,000 g = \_\_\_\_\_ kg      7. 50 kg = \_\_\_\_\_ g

Choose the best unit of measure. Write *gram*, *kilogram*, *milliliter*, or *liter*. (Lesson 8–9)

8. the amount of water in a bathtub      9. the mass of a truck      10. the mass of a grape

## Crafty Conversions

### Calculator

### Connection

Use your calculator to estimate conversions between metric and customary units.

1. 5 yd is about \_\_\_\_\_ m      2. 12 oz is about \_\_\_\_\_ g  
3. 36 lb is about \_\_\_\_\_ kg      4. 5 mi is about \_\_\_\_\_ km  
5. 10 cm is about \_\_\_\_\_ in.      6. 6 qt is about \_\_\_\_\_ L

#### Estimated Equivalents

##### Length

1 in. is about 2.5 cm.  
1 yd is about 0.9 m.  
1 mi is about 1.6 km.

##### Weight/Mass

1 oz is about 28 g.  
1 lb is about 0.5 kg.

##### Capacity

1 qt is about 0.9 L.



# Chapter Review/Test

## VOCABULARY

Choose the best word to complete each sentence.

1. A unit used to describe mass is a \_\_\_\_.
2. A unit used to describe length is a \_\_\_\_.
3. A unit used to describe liquid measure is a \_\_\_\_.

**Vocabulary**

mile  
liter  
gram  
weight

## CONCEPTS AND SKILLS

Measure this ribbon. (Lessons 1 and 6, pp. 306–307, pp. 318–319)



4. to the nearest inch
5. to the nearest quarter inch
6. to the nearest centimeter
7. to the nearest millimeter

Find each missing number. (Lessons 2–4, pp. 308–314)

- |                     |                    |                     |
|---------------------|--------------------|---------------------|
| 8. 4 yd = ____ in.  | 9. 60 ft = ____ yd | 10. 2 mi = ____ ft  |
| 11. 5 gal = ____ qt | 12. 12 c = ____ pt | 13. 2 gal = ____ c  |
| 14. 4 lb = ____ oz  | 15. 2 T = ____ lb  | 16. 32 oz = ____ lb |

Choose the metric unit you would use to describe each. (Lessons 7–9, pp. 320–328)

17. the length of a flea
18. the capacity of a sink
19. the mass of a pencil

## PROBLEM SOLVING

Solve. (Lesson 5, p. 316)

20. Maria is 3 ft 9 in. tall. Naeem is 47 in. tall. Paula is 5 ft tall. What is the difference in inches between Paula's height and Naeem's height?

**Write About It**

**Show You Understand**

Tony has a 22 gallon aquarium. Ian said that it holds 90 quarts of water. Is Ian correct?

Explain why or why not.



## Extra Practice

### Set A (Lesson 2, pp. 308–309)

Find each missing number.

1. 3 yd = \_\_\_\_ in.

2. 24 in. = \_\_\_\_ ft

3. \_\_\_\_ in. = 6 ft

4. \_\_\_\_ ft = 1 mi

5. 4 yd = \_\_\_\_ ft

6. 3 mi = \_\_\_\_ yd

### Set B (Lesson 3, pp. 310–311)

Find each missing number.

1. 16 c = \_\_\_\_ pt

2. 4 gal = \_\_\_\_ c

3. 8 pt = \_\_\_\_ gal

4. \_\_\_\_ gal = 12 qt

5. 11 pt = \_\_\_\_ c

6. \_\_\_\_ pt = 6 qt

### Set C (Lesson 4, pp. 312–314)

Compare. Write  $>$ ,  $<$ , or  $=$  for each  $\odot$ .

1. 3,000 lb  $\odot$  3 T

2. 6 lb  $\odot$  80 oz

3. 36 oz  $\odot$  2 lb

### Set D (Lesson 7, pp. 320–321)

Find each missing number.

1. 3 dm = \_\_\_\_ cm

2. 5 cm = \_\_\_\_ mm

3. 200 cm = \_\_\_\_ m

4. \_\_\_\_ km = 5,000 m

5. 30 cm = \_\_\_\_ dm

6. 700 mm = \_\_\_\_ cm

### Set E (Lesson 8, pp. 322–324)

Find each missing number.

1. 2 L = \_\_\_\_ mL

2. \_\_\_\_ L = 6,000 mL

3. \_\_\_\_ mL = 10 L

4. 4000 mL = \_\_\_\_ L

5. \_\_\_\_ mL = 8 L

6. 5 L = \_\_\_\_ mL

### Set F (Lesson 9, pp. 326–328)

Compare. Write  $>$ ,  $<$ , or  $=$  for each  $\odot$ .

1. 2 kg  $\odot$  2,500 g

2. 17 kg  $\odot$  17,000 g

3. 850 g  $\odot$  85 kg